Haimeng Zhao

Website: hmzhao.me
Email: haimengzhao@icloud.com
GitHub: github.com/JasonZHM

Last Updated: December 1, 2022

Education

- **Tsinghua University** — Beijing, China
  Zhili College, B.Sc. in Physics, Minor in Statistics — 2020–2024(Expected)
  GPA: **3.95/4.00**, Major GPA: **4.00/4.00**, Rank: **1/50**
  English: GRE 335 (166/V+169/Q+3.5/AW)
- **EPFL (École Polytechnique Fédérale de Lausanne)** — Lausanne, Switzerland
  Exchange, Physics, Advisor: Giuseppe Carleo & Filippo Vicentini — 2022 Fall

Research Interest

- How the universe works,
and how can we possibly understand it?

- AI for Science, especially Physics & Astrophysics
- Quantum Information, Algorithms & Machine Learning
- Quantum Many-body Physics: Theory & Computation
- Generative Learning, Neural Differential Equations

Skills

- **Computational Physics:** Exact Diagonalization, (Quantum) Monte Carlo, DFT, Tensor Network, NQS
- **(Quantum) Machine Learning:** (Quantum) Generative Learning, Neural Differential Equations, (PAC) Learning Theory
- **Programming:** High performance scientific computing with Python & C++. Differentiable programming with JAX, PyTorch (6 years) & TensorFlow.

Publications

[1] **H. Zhao** and W. Zhu, "MAGIC: Microlensing Analysis Guided by Intelligent Computation", *The Astronomical Journal*, vol. 164, no. 5, p. 192, 2022. arXiv: 2206.08199 [astro-ph.IM].

[2] **H. Zhao** and W. Zhu, "Parameter Estimation in Realistic Binary Microlensing Light Curves with Neural Controlled Differential Equation", *ICML 2022 Workshop on Machine Learning for Astrophysics*, 2022.

[3] **H. Zhao**, "Exact Decomposition of Quantum Channels for Non-IID Quantum Federated Learning", *Quantum Machine Intelligence*, 2022, Revised. arXiv: 2209.00768 [quant-ph].

[4] J. Liu*, Y. Tang*, **H. Zhao**, F. Li, and J. Zhang, "CPS Attack Detection under Limited Local Information in Cyber Security: A Multi-node Multi-class Classification Ensemble Approach", *ACM Transactions on Sensor Networks (TOSN)*, 2022, Revised. arXiv: 2209.00170 [cs.CR].

[5] **H. Zhao** and P. Liao, "CAE-ADMM: Implicit Bitrate Optimization via ADMM-based Pruning in Compressive Autoencoders", 2019. arXiv: 1901.07196 [cs.CV].

Research Experience

- **AI for Astro: Parameter Estimation of Realistic Binary Microlensing Events** — Oct. 2021 - Sep. 2022
  Advisor: Prof. Wei Zhu, Department of Astronomy @ Tsinghua — **First Author**
  Introduced U-Net and neural controlled differential equations to parameter estimation of microlensing. Developed a machine learning framework for efficiently & accurately analyzing irregular and noisy ground-observed astronomical time series with large data gaps. Obtained the first real micolensing event ever analyzed by AI!

- **Federated Learning in Multi-class Classification** Apr. 2022
  *In **collaboration** with Prof. Jingyi Zhang, Center for Statistical Science @ Tsinghua and also my friends Junyi & Yifu*

  Proved the key theorem in the paper, which enables one to merge partial classifiers trained in different nodes into a global one without leaking private data.

- **Quantum AI: A Quantum Generative Model based on Variation qPCA** Nov. 2021 - Mar. 2022
  Advisor: Prof. Dongling Deng, Institute for Interdisciplinary Information Sciences @ Tsinghua **First Author**

  Proposed a simple yet powerful quantum generative model based on variational quantum principal component analysis (G-qPCA). Conceptually unified the quantum version of GAN, VAE and normalizing flow. Along the way, proposed a fully quantum formulation of variational autoencoder and normalizing flow. It's also implementable on NISQ devices and free from QRAM.

- **AI for HEP-Ex: A Neutrino Data Analysis Tournament** Jan. 2021 - Jun. 2021
  Advisor: Prof. Benda Xu, Department of Engineering Physics @ Tsinghua. **First Prize & Most Innovative Algorithm**

  Led a team that developed a simulation & machine learning pipeline to promote neutrino energy detection precision, a key step towards understanding the neutrino mass ordering problem.

- **AI for Vision: Learned Lossy Image Compression** 2018 - 2019
  Advisor: the Internet. In collaboration with a friend Peiyuan back in high school. **First Author**

  Introduced a pruning method originally used in neural architecture search to the field of lossy image compression. Achieved the state-of-the-art performance with much simpler training procedure.

Selected Coursework

* for graduate courses.

Computational Quantum Physics*	A+	Quantum Artificial Intelligence*	A
Solid State Physics	A+	Atom and Molecule Physics	A
Analytical Mechanics	A	Quantum Mechanics	A
Statistical Mechanics	A	Electrodynamics	A+
Complex Analysis	A+	Mathematical Physics Equations	A+
Statistical Inference	A	General Relativity	A

Self taught: Quantum Field Theory, Lattice Field Theory, Topology, Group Theory, Theoretical Computer Science, Quantum Computer Science.

Scholarships and Awards

- National Scholarship (National Highest Honor for Undergrads) 2022
- Dean's Award (Highest Honor in Zhili College) 2022
- Chi-sun Yeh Scholarship (Highest Honor for Physics Major), Tsinghua Xuetang Talents Program 2020–2022
- Scholarship of Comprehensive Excellence, Tsinghua University 2020–2022
- S.-T. Yau College Student Mathematics Contest, Finalist (Mathematical Physics) 2022
- Alibaba Global Mathematics Competition, Finalist, Global Top 300 2021
- S.-T. Yau High School Science Award (Computer), Global Gold Prize 2019
- The Awarding Program for Future Scientists, National Top 3 2019
- Chinese Physics Olympiad, Finalist, Bronze Medal 2019